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SILVICAL LEAFLET 10.

BIGCONE SPRUCE.

Pseudotsuga macrocarpa (Torr.) Mayer.

Bigcone spruce forms a part of the scanty forest in a semiarid region much in need of forest cover. Within its limited range it is of economic value on account of its adaptability to situations too dry for most other timber trees.

RANGE AND OCCURRENCE.

Bigcone spruce occurs in the coast ranges of southern California from the southern part of Santa Barbara County and the southwestern corner of Kern County southward to Lower California. At its northern limit it extends from Mission Canyon, near Santa Barbara, northeastward to Tejon Canyon west of Tehachapi. It confines itself chiefly to the mountainous country and adjacent hills of the Santa Barbara, San Gabriel, San Bernardino, and San Jacinto National Forests, and forms a crescent with the coast from Santa Barbara County to San Diego, following, in general, the San Inez, Zaca, San Emigdio, Pine, Libre, Sierra Madre, San Bernardino, San Jacinto, Palomar, Balkan, and Cuyamaca mountains. It is most common in the Sierra Madre and San Bernardino mountains. In the Santa Barbara National Forest it is most common on the watersheds of the Matilija, Cuyama, Sespe, and Piru creeks. It grows chiefly at elevations of from 3,000 to 6,000 feet, but follows canyons and ravines down to 1,500 feet and ascends into the pine forests to an elevation of 8,000 feet.

CLIMATE.

The region in which bigcone spruce grows does not receive sufficient precipitation to support a satisfactory forest cover. The aver-

age annual precipitation varies from less than 10 inches to 30 inches, and the relative humidity of the atmosphere is correspondingly low. The amount of precipitation at high elevations and on the seaward slope of the Coast ranges is greater than on the east side, which faces the dry interior. Precipitation falls chiefly during the winter, as rain at lower elevations and as snow at higher altitudes. On Pine Mountain in the Santa Barbara National Forest and at high elevations in the San Gabriel and San Bernardino mountains snowstorms sometimes occur at the upper limit of the bigcone spruce as late as May and as early as October. Only at elevations above the range of bigcone spruce, however, does snow accumulate and remain on the ground. At lower elevations it usually melts while it falls or soon after. During the rainy season in these mountains fog commonly adds to the moisture available for tree growth. A large proportion of the precipitation which reaches the ground never penetrates the soil, but passes off again into the air, and is valueless as a moisture supply for tree roots.

The summers are long, hot, and dry, with an occasional thunderstorm, hailstorm, or cloudburst on the higher mountains. Dew is practically unknown. The period from July to October, inclusive, is one of great danger from forest fires. During this period the forest floor is very dry and inflammable, and a fire once started is hard to control. In this region the destructive effect of forest fires is especially severe, and once destroyed the forest is hard to replace.

HABIT.

Bigcone spruce has a strong, spreading root system and a conical open crown. It occasionally reaches a diameter of from 3 to 4 feet and a height of 80 feet, but is usually much smaller, especially in height. In dry, exposed situations it is gnarled and branchy. It has small commercial value, since it occurs scattered in rather inaccessible localities, and its timber is not of high quality. The wood of bigcone spruce is heavy, hard, strong, and close grained, but not durable. It is locally used as fuel and to a small extent for lumber.

ASSOCIATED SPECIES.

The timbered areas within the range of bigcone spruce are scattered and of limited extent. Among them the spruce never forms dense, continuous stands, but grows in patches, groups, or singly, scattered through the chaparral and oak growth. As a rule it occupies an intermediate position between the chaparral and the pine belt. It extends down into the chaparral as far as moisture conditions permit, and up among the pines as far as the more severe cli-

matic conditions allow. It does not, however, extend solidly between these two types of vegetation, but is interrupted, usually by areas of chaparral, a result partly of frequent fires in the past and partly of local soil and moisture conditions. In the lower part of the pine belt and in the chaparral below, bigcone spruce is associated with canyon live oak. Its other common associates in the pine belt are Coulter, yellow, Jeffrey, and sugar pines, incense cedar, and white fir.

SOIL AND MOISTURE.

Bigcone spruce confines itself chiefly to the cooler situations and fresh soils in canyons, ravines, draws, and on northerly slopes. It avoids wet stream beds and swampy situations. It also grows on rocky, shallow soils and in situations too dry for the development of other conifers found within its range, such as Jeffrey pine, yellow pine, sugar pine, white fir, and incense cedar.

TOLERANCE.

After its seedling stage bigcone spruce requires full overhead light for its best development. Although in moist, sheltered situations reproduction may take place in the open, seedlings as a rule need some shade, and will come up and thrive in the shade of live oak and under seed trees. On account of light requirements, mature stands of bigcone spruce are usually open. As a rule the stems are clear of branches for one-third or more of their length, though the branches extend to the ground in the open and occasionally in chaparral.

REPRODUCTION.

On account of its poor seeding capacity and the frequent occurrence of forest fires in the past, reproduction of bigcone spruce is scanty. Although the tree bears some seed nearly every year, seasons of abundant production are infrequent. A considerable percentage of the seeds are not fertile. Many of them are destroyed by mice, squirrels, and birds, and a large number of those which escape fail to find proper conditions for germination and growth.

The seeds mature in one season, and fall between August and October. They find a satisfactory seed bed on fresh mineral soil and also in the leaf litter under live oak stands. The seedlings grow slowly at first, but enter upon a period of rapid height growth as they become well established and begin to need a greater amount of light.

